

### Sampling-General

- For consistency, use the kitchen faucet for all samples collected.
- Use only cold water.
- Open the cold water tap all the way when filling the bottles, as you would when filling a glass of water.
- Use wide-mouth 1-Liter bottles so that residents can fully open the faucet, reflecting a normal household use to fill a glass. Narrow mouth bottles can result in residents limiting the flow to avoid spilling water outside of the bottle.
- Based on Milwaukee's water quality, samples should be analyzed for Pb, Cu, Fe, Zn, Al, P, Cd, Ca, Cl. These constituents are very useful for assessing where the relative contributions of Pb are coming from in the plumbing network.
- Collect 15 sequential 1-Liter samples at each site. This is more than we collected in Chicago, but the homes that were sampled in Chicago were not targeted based on water main work as would be the case in Milwaukee. Since the lead service line is being disturbed at the water main, you would want to ensure that there are enough sequential samples to capture lead levels at the sites where the lead lines are disturbed. If the home is set far back on the property, more samples may be needed to reach the water main.

### Sequential Sampling Instructions (before/after water main work)

1. The night before sampling (right before everyone goes to bed) run the water from the kitchen tap for at least 5 minutes. Do not remove the aerator. Write down the date/time you finished running the water on the form. After running the water for 5 minutes, no water should be used in the home until samples are collected at least 6 hours later.
2. In the morning, note the date and time right before collecting the samples. You will collect 15 samples in a row, one after another, without shutting off the water in between samples. To prepare to do this, remove the caps from all eleven bottles before you turn on the water.
3. Place the 15 open bottles in order by sample number before you start collecting the samples with the numbers on the bottles facing you. Try not to waste water in between the samples. You can put the caps on after all 15 samples have been collected. The bottles are numbered 01 through 15. **It is very important to collect the samples in order** (Bottle 01 first, bottle 02 second, etc.) until all sample bottles have been filled.
4. Place the 1<sup>st</sup> bottle (bottle 01) under the tap and gently but fully open the cold water tap.
5. Have the next bottle ready in your other hand. When the sample bottle is filled to the designated line/mark, quickly place the next bottle under the tap and repeat this until all bottles are filled.

### Additional sampling for consideration

You may wish to consider adding a 5 minute flushed sample for each site. In anticipation of having to provide advice to residents with lead service lines in Chicago, we collected 3-minute, 5-minute and 7-minute flushed samples. This information was used to inform residents on the

amount of time it may take to lower lead levels down to the baseline (lowest) levels. For most sites, flushing for more than 5 minutes did not result in any significant reduction over a 5 minute flush. In Lansing, MI, a system-specific study using similar sampling protocols recommended 7 minutes.

Once a flushing time was determined overall and in order to conserve water, rather than instructing residents to flush the kitchen tap for 5 minutes to lower lead levels, we recommended that following a high water use event in the home (showering/bathing, washing clothes or doing dishes), they flush the kitchen tap an additional 1-2 minutes to clear the interior plumbing and laterals and collect water for use during the day.

Alternatively, a filter certified to remove particulate and dissolved lead can be provided to residents or recommended. At last check, there was only one pitcher filter certified for both particulate and dissolved lead, so most will be tap-mount filters. Note that filters should not be used in lieu of flushing the lines thoroughly following any lead service line disturbance as these events can release very high levels of lead-bearing scale and sediment which may be beyond the capabilities of certified filter performance according to the manufacturer specifications.

Recommendations should also include periodic aerator cleaning following the water main work.

### **Flushing after Water Main Work**

Whenever lead service lines are disturbed, scale and sediment containing extremely high lead levels can be released into the water. From a public health perspective, these levels can be dangerous if ingested. Consequently, flushing after lead service line disturbances is the most important activity for utilities to perform.

Attached is a 2015 study published in the Journal of the American Water Works Association on flushing following partial or full lead service line replacement or disturbances to lead service lines. I would recommend the protocol using a 10 minute outside flush (hose bib) in combination with the longer flushing of the internal plumbing. This appears to be more effective than flushing only the outside tap for 10 or 20 minutes.

Note that for this flushing activity, the aerators should be removed to allow the water to flow as rapidly as possible to mobilize and clear the lead-bearing particles and sediment from the plumbing.

### **Observational Notes from our Chicago Study**

Most of the homes with high lead levels in our Chicago study had lead service line disturbances prior to the initiation of our study, so in addition to the actual disturbance that knocked off the protective scale, another factor may be that adequate flushing was not performed following the disturbance and some of the dislodged scale and sediment remained in the plumbing network. Finally, another possible factor for the high lead sites anecdotally is that lower water use may also have been a factor at these sites, and perhaps a significant factor. Many were not metered, so we could not analyze the significance of the higher vs. lower water use on lead levels. Water

usage data, if available, would be an important factor to consider when studying the results from each site.

### **Looking ahead**

I would be remiss if I did not mention potential EPA actions that might affect Milwaukee in the upcoming Lead and Copper Rule revisions. As you know, the NDWAC is currently developing recommendations for EPA on the revisions. Potential recommendations may include a recommendation that EPA establish a requirement for systems with lead service lines to develop programs for removing all lead service lines. I mention this for the following reasons:

- 1) Milwaukee will be doing water main work and it may be worth assessing whether such a program might make sense in terms of a permanent solution to the lead in drinking water issue that would also not result in complications with phosphorus discharges in Wisconsin.
- 2) Information presented to the NDWAC indicates that up to 70 percent of systems with lead service lines would not meet the lead action level consistently using the revised sampling protocol options being discussed, so additional treatment changes including higher phosphate may be needed to adequately control lead levels. Recent estimates are that systems with lead service lines may need to increase phosphate levels 2-3 times what is currently being used for lead control.
- 3) The cost of lead service line replacement can be reduced significantly when combined with other infrastructure work. My recollection is that Lansing, MI reduced the cost of lead service line replacement by approximately 40% by combining it with CSO work.